

STUDENTS' PERCEPTIONS OF ELECTRONIC STUDENT WORKSHEETS, LEARNING MOTIVATION, AND ACADEMIC ACHIEVEMENT IN ISLAMIC CULTURAL HISTORY: EVIDENCE FROM AN INDONESIAN MADRASAH

^{*1}Aldy Evrial Sony, ²Fitri Oviyanti, ³Saipul annurr, ⁴Nyayu Soraya, ⁵Febrianti

^{*1,2,3,4,5}UIN Raden Fatah Palembang

Email: ^{*1,2,3,4,5}aldyevrialsonspd@gmail.com

Abstract

Digital learning resources are increasingly embedded in secondary education, yet their educational value depends on how learners engage with the activities that digital tools make possible. Electronic student worksheets (E-LKPD) are potentially useful because they combine structured learning tasks with digital access, interactivity, and opportunities for independent work. This study examines the relationship between students' perceived use of E-LKPD, learning motivation, and academic achievement in Islamic Cultural History (Sejarah Kebudayaan Islam; SKI) at an Indonesian madrasah. A quantitative cross-sectional survey was conducted with 65 students at MA Rabi'atul Adawiyah Baturaja during the 2025/2026 academic year. Data were collected using a 28-item Likert-scale measure of perceived E-LKPD use, a 25-item measure of learning motivation, and documented end-of-semester achievement scores. The manuscript's original descriptive analysis reported a mean E-LKPD score of 111.52 (SD = 5.356), a mean motivation score of 97.78 (SD = 5.293), and a mean achievement score of 86.03 (SD = 2.437). The original multivariate analysis reported a significant association between E-LKPD and the two outcomes (Wilks' $\Lambda = .013$, $F = 16.528$, $p < .001$). However, statistical auditing identified a critical model-specification problem: the reported multivariate test assigns 40 hypothesis degrees of freedom to E-LKPD, indicating that the predictor was entered as a categorical factor rather than as the continuous scale score described in the methods. Because this coding decision is not theoretically justified and is incompatible with the stated research design, the reported effect size (partial $\eta^2 = .885$) should not be interpreted as a valid causal effect until the raw data are reanalyzed using an appropriate multivariate regression model. The study therefore provides a useful empirical basis for examining E-LKPD in SKI while also illustrating the importance of aligning measurement, coding, and multivariate analysis in educational technology research.

Keywords: electronic student worksheet, E-LKPD, learning motivation, academic achievement, Islamic Cultural History, digital learning, madrasah

Abstrak

Sumber belajar digital semakin terintegrasi dalam pendidikan menengah, tetapi nilai edukatifnya bergantung pada bagaimana peserta didik terlibat dalam aktivitas yang difasilitasi oleh teknologi digital tersebut. Electronic student worksheets (E-LKPD) berpotensi mendukung pembelajaran karena menggabungkan tugas belajar yang terstruktur dengan akses digital, interaktivitas, dan peluang untuk belajar secara

mandiri. Penelitian ini mengkaji hubungan antara persepsi peserta didik terhadap penggunaan E-LKPD, motivasi belajar, dan pencapaian akademik dalam mata pelajaran Sejarah Kebudayaan Islam (SKI) pada sebuah madrasah di Indonesia. Penelitian menggunakan pendekatan kuantitatif dengan desain potong lintang (cross-sectional) yang melibatkan 65 peserta didik di MA Rabi'atul Adawiyah Baturaja selama tahun akademik 2025/2026. Data dikumpulkan menggunakan instrumen skala Likert 28 butir untuk mengukur persepsi terhadap penggunaan E-LKPD, instrumen 25 butir untuk mengukur motivasi belajar, serta nilai pencapaian akademik yang diperoleh dari dokumentasi hasil belajar pada akhir semester. Analisis deskriptif awal dalam manuskrip melaporkan skor rata-rata E-LKPD sebesar 111,52 ($SD = 5,356$), skor rata-rata motivasi belajar sebesar 97,78 ($SD = 5,293$), dan skor rata-rata pencapaian akademik sebesar 86,03 ($SD = 2,437$). Analisis multivariat awal melaporkan adanya hubungan yang signifikan antara E-LKPD dan kedua variabel hasil ($Wilks' \Lambda = 0,013$, $F = 16,528$, $p < 0,001$). Namun, audit statistik mengidentifikasi masalah kritis dalam spesifikasi model: hasil uji multivariat menunjukkan 40 derajat kebebasan hipotesis (hypothesis degrees of freedom) untuk variabel E-LKPD, yang mengindikasikan bahwa prediktor dimasukkan sebagai faktor kategorikal, bukan sebagai skor skala kontinu sebagaimana dijelaskan dalam metode penelitian. Keputusan pengodean tersebut tidak memiliki justifikasi teoretis yang memadai dan tidak sesuai dengan desain penelitian yang dinyatakan. Oleh karena itu, ukuran efek yang dilaporkan sebelumnya ($\text{partial } \eta^2 = 0,885$) tidak seharusnya ditafsirkan sebagai efek kausal yang valid sebelum data mentah dianalisis ulang menggunakan model regresi multivariat yang sesuai. Dengan demikian, penelitian ini memberikan dasar empiris yang bermanfaat untuk mengkaji penggunaan E-LKPD dalam pembelajaran SKI, sekaligus menunjukkan pentingnya keselarasan antara pengukuran, pengodean variabel, dan analisis multivariat dalam penelitian teknologi pendidikan.

Kata kunci: lembar kerja peserta didik elektronik, E-LKPD, motivasi belajar, pencapaian akademik, Sejarah Kebudayaan Islam, pembelajaran digital, madrasah

INTRODUCTION

Digital technology has moved from being an optional supplement to becoming an important component of contemporary educational practice. However, the educational value of digital technology cannot be inferred simply from the presence of a device, platform, or electronic learning material. Recent evidence indicates that the effects of technology-enhanced learning depend substantially on what learners actually do with the technology. A second-order synthesis of meta-analyses found that digital technology does not automatically improve cognitive learning outcomes when it merely substitutes for non-digital instruction; stronger effects emerge when technology provides activity-specific cognitive support and promotes active, constructive, or interactive learning activities. Similarly, a meta-analysis of 60 empirical studies reported positive effects of digital technology on deep learning, particularly when digital tools were systematically integrated and accompanied by instructional guidance (Sailer et al., 2024; Wu, 2024).

This distinction is particularly relevant to electronic student worksheets (E-LKPD). Unlike a digital textbook that primarily delivers information, an electronic worksheet can organize learning into sequenced tasks, questions, prompts, multimedia resources, and

opportunities for feedback. Its pedagogical value therefore lies not only in digitizing a printed worksheet but also in structuring learner activity. Recent Indonesian studies have reported positive outcomes from E-LKPD interventions, including improvements in learning achievement and learner responses, although much of this literature remains concentrated on product development, feasibility, or single-subject outcomes rather than on theoretically informed examinations of students' motivational and academic responses. For example, quasi-experimental research on SETS-based E-LKPD reported significant pretest–posttest improvement, while recent development studies have demonstrated the practicality and effectiveness of interactive E-LKPD products (Puspita Sari et al., 2022; Ghaisani & Setyasto, 2023; Ashari & Sukarmin, 2026).

Learning motivation is particularly important because technology-supported learning requires students to regulate attention, persist with tasks, and engage actively with instructional materials. Self-Determination Theory (SDT) proposes that motivation is shaped by the satisfaction of three basic psychological needs: autonomy, competence, and relatedness. Digital learning environments can support motivation when they provide meaningful choices, manageable challenges, clear feedback, and opportunities for interaction. Recent research applying SDT to digital learning has similarly emphasized the importance of perceived competence and supportive learning environments in sustaining motivation (Shank et al., 2025; Dong, 2025). Nevertheless, digital technology can also fail to enhance motivation when it increases cognitive or technical demands without providing adequate pedagogical support.

The relationship between technology and learning achievement is equally complex. Digital resources can support learning by increasing accessibility, providing multimodal representations, enabling practice, and supporting feedback. Yet evidence suggests that technology is most effective when its design is aligned with the learning activity rather than treated as an end in itself. Hooshyar et al. (2024), for example, found that technology-enhanced learning can improve cognitive and non-cognitive outcomes, but the magnitude of effects varies according to instructional design and contextual factors. These findings suggest that an electronic worksheet should be examined as a pedagogical environment rather than merely as a digital format.

This issue is particularly relevant in Islamic Cultural History (SKI) in Indonesian madrasahs. SKI combines historical knowledge with interpretation of events, values, exemplary behavior, and cultural meaning. In classroom practice, however, the subject may be perceived by students as heavily dependent on remembering names, dates, events, and narratives. Under such conditions, an electronic worksheet may provide an opportunity to shift learning from passive reception toward guided reading, analysis, questioning, and independent task completion. Such a shift is theoretically consistent with research emphasizing active learning and structured digital support.

The present study focuses on MA Rabiatul Adawiyah Baturaja, where preliminary observation identified variation in students' participation and academic achievement in

SKI. Some students demonstrated active engagement, whereas others were relatively passive in discussion and task completion. The school context therefore provides a relevant setting for examining whether students' perceptions of E-LKPD use are statistically related to learning motivation and academic achievement.

The literature, however, leaves several issues unresolved. First, much of the E-LKPD literature has focused on development and feasibility rather than on the simultaneous relationship between perceived E-LKPD use, motivation, and achievement. Second, evidence from Islamic Cultural History at the madrasah aliyah level remains comparatively limited. Third, technology-use research increasingly indicates that the quality and nature of learning activity matter, suggesting that simple claims that “digital technology improves learning” are theoretically insufficient.

Accordingly, this study asks: (1) What are the descriptive characteristics of students' perceived E-LKPD use, learning motivation, and SKI achievement? and (2) Is perceived E-LKPD use statistically associated with learning motivation and academic achievement when the two outcomes are examined simultaneously?

The contribution of the study is intentionally modest and evidence-based. It does not claim that E-LKPD is universally effective. Instead, it provides school-level evidence from an underrepresented subject and educational context while emphasizing the need to align digital learning design with motivational and cognitive processes.

An E-LKPD can be conceptualized as a digital learning worksheet that combines instructional content with structured learner activities. Its educational function depends on features such as accessibility, clarity, interactivity, usefulness, and opportunities for independent task completion. From a multimedia-learning perspective, well-designed combinations of verbal and visual information can support meaningful processing when they are organized in ways that reduce unnecessary cognitive demands (Mayer, 2021). However, multimedia itself does not guarantee learning; the instructional task and the learner's cognitive activity remain central.

The ICAP-oriented literature provides an additional explanation. Technology is more likely to improve learning when it moves students toward active, constructive, and interactive engagement rather than passive exposure (Sailer et al., 2024). An E-LKPD can support this process when it asks students to interpret information, answer questions, compare evidence, solve problems, and produce responses rather than simply read content.

SDT provides a useful motivational lens. E-LKPD may support autonomy by allowing students to work through materials at an appropriate pace and revisit content; competence by providing structured tasks and feedback; and, when integrated into collaborative classroom activity, relatedness through shared discussion and peer interaction. These mechanisms should be understood as theoretical possibilities rather than as directly tested mediators in the present study.

Recent research supports the relevance of this framework to digital learning. Shank et al. (2025) found that an SDT-informed online course was associated with improvements in students' perceived competence and relatedness. Dong (2025) similarly reported relationships among digital engagement, digital self-efficacy, and motivation. These studies suggest that the motivational value of digital tools depends on how students experience and use them.

Academic achievement reflects students' demonstrated attainment of intended learning outcomes. Digital worksheets may support achievement through structured practice, retrieval, feedback, and active engagement. Meta-analytic evidence indicates that digital technology can positively affect learning, but the magnitude of the effect is sensitive to instructional design, guidance, and the learning activities enabled by the technology (Wu, 2024; Sailer et al., 2024). The present study therefore conceptualizes perceived E-LKPD use as an educational resource that may be associated with motivation and achievement. Because the study uses a cross-sectional, nonexperimental design, the framework does not justify a causal claim.

METHOD

Research design and setting

The study employed a quantitative cross-sectional design. Data were collected at MA Rabiatal Adawiyah Baturaja, Ogan Komering Ulu, South Sumatra, Indonesia, during the 2025/2026 academic year. The original manuscript described the design as *ex post facto* and correlational. Because no experimental manipulation or comparison group was reported, the revised manuscript treats the design as observational rather than experimental.

Participants

The population consisted of 65 students enrolled in SKI across three grade levels. Because the population was small and accessible, all 65 students were included (total population sampling). Thus, the analyzed sample was $N = 65$. The manuscript should report the distribution of participants by grade, age, and gender in the final version if these data are available, because these characteristics are important for assessing the sample's representativeness and transferability.

Measures

Three sources of data were used.

Perceived E-LKPD use. Students completed a 28-item Likert-scale questionnaire covering ease of use, visual attractiveness, interactivity, clarity of material, usefulness, accessibility, and perceived instructional effectiveness. Importantly, because the instrument measures students' responses to their experience of E-LKPD, the construct should be described as perceived E-LKPD use rather than objective "use" unless usage logs are available.

Learning motivation. A 25-item Likert-scale questionnaire assessed six dimensions: desire to succeed, learning needs, aspirations and expectations, recognition or appreciation in learning, engaging learning activities, and a supportive learning environment.

Academic achievement. Achievement was represented by documented scores from the first-semester Final Assessment (Penilaian Akhir Semester/PAS) for SKI.

The original manuscript states that item validity was examined using Pearson product-moment correlations and internal consistency using Cronbach's alpha. For a Scopus-targeted submission, the authors should report the number of valid items after validation, item-total statistics or factor evidence where appropriate, Cronbach's alpha or preferably omega, and the evidence used to establish content validity. These statistics were not fully reported in the uploaded manuscript and therefore are not reconstructed here.

Data analysis

The original manuscript analyzed the data using descriptive statistics, normality, linearity, heteroscedasticity, and a multivariate test reported as MANOVA. A statistical audit of the uploaded SPSS output, however, identified a critical specification issue. The multivariate output assigns 40 hypothesis degrees of freedom to E-LKPD, despite the methods describing E-LKPD as a continuous questionnaire score. This indicates that E-LKPD was entered as a categorical factor with multiple levels in the reported model. Such a specification is not appropriate for the stated research question unless categories were theoretically defined in advance and had adequate group sizes. The appropriate primary analysis for the stated design is multivariate multiple regression, with the continuous E-LKPD score as the predictor and motivation and achievement as the two correlated outcomes. If the authors instead intend to compare predefined E-LKPD groups, a defensible categorization rule and adequate observations per group must be documented. Because the raw dataset is not included with the manuscript, the corrected multivariate coefficients, confidence intervals, R^2 values, and effect estimates cannot be calculated reliably at this stage.

RESULT AND DISCUSSION

Descriptive statistics

The original manuscript reported the following descriptive statistics for $N = 65$: perceived E-LKPD use, $M = 111.52$, $SD = 5.356$; learning motivation, $M = 97.78$, $SD = 5.293$; and academic achievement, $M = 86.03$, $SD = 2.437$.

These values should be interpreted descriptively rather than as evidence that E-LKPD caused higher motivation or achievement. In particular, a high perceived-use score indicates favorable student perceptions of the E-LKPD experience; it does not establish that E-LKPD increased the outcomes. A data-verification issue must be resolved before submission. The normality output embedded in the uploaded manuscript reports an achievement mean of 89.29 and $SD = 6.656$, whereas the descriptive-statistics section

reports $M = 86.03$ and $SD = 2.437$. Both cannot simultaneously represent the same 65 observations. The final manuscript must use the values reproduced directly from the raw dataset and verified SPSS output.

Assumption checks

The uploaded manuscript reports Kolmogorov–Smirnov significance values of .277 for E-LKPD, .058 for motivation, and .081 for achievement, and Deviation from Linearity significance values of .068 for E-LKPD–motivation and .133 for E-LKPD–achievement. The Glejser test reportedly yielded $p = .420$. These results provide some evidence that the variables did not show strong departures from the specific assumptions tested. Nevertheless, for a multivariate regression analysis, the final report should additionally include examination of multivariate outliers, influential observations, residual diagnostics, and the covariance between the two dependent variables. The authors should also avoid reporting multicollinearity diagnostics as a substantive finding when there is only one predictor; with a single predictor, conventional predictor-to-predictor multicollinearity cannot occur.

Original multivariate output and statistical interpretation

The original SPSS multivariate output reports Wilks' Lambda = .013, $F = 16.528$, $p < .001$, with partial $\eta^2 = .885$. However, the same output reports 40 hypothesis degrees of freedom for the E-LKPD effect. This is the central statistical issue in the manuscript. A 28-item questionnaire producing a continuous total score should not automatically be treated as a 41-level categorical predictor. The reported 40 degrees of freedom strongly suggests that the analysis did not correspond to the continuous-predictor model described in the Methods section. Consequently, the reported partial $\eta^2 = .885$ should not be presented as a valid estimate of the effect of E-LKPD until the analysis is rerun using the correct variable coding.

DISCUSSION

The descriptive pattern in the original manuscript indicates that students generally reported favorable experiences with E-LKPD and relatively high motivation and achievement. This pattern is compatible with the broader literature suggesting that well-designed digital learning resources can support engagement and learning. However, the present evidence should not be interpreted as demonstrating that E-LKPD itself produced the observed levels of motivation or achievement. The distinction between technology and learning activity is important. Sailer et al. (2024) found that technology-enhanced learning has stronger cognitive benefits when digital tools provide specific support for learning activities. Wu (2024) likewise reported a positive overall effect of digital technology on deep learning while emphasizing instructional guidance and systematic integration. From this perspective, the potential value of E-LKPD in SKI may lie in its ability to organize students' activities around reading, interpreting historical information, answering questions, comparing perspectives, and completing structured tasks. The

medium is therefore not the mechanism by itself; the mechanism is the quality of activity that the medium makes possible.

The motivational interpretation can be framed through SDT. When E-LKPD allows students to navigate material independently, provides clear task structures, and offers manageable learning challenges, it may contribute to perceptions of autonomy and competence. Contemporary research on digital learning similarly indicates that digital engagement and perceived competence are relevant to motivation (Dong, 2025; Shank et al., 2025). Nevertheless, the current study did not directly measure autonomy, competence, relatedness, or digital self-efficacy. Therefore, these mechanisms remain theoretically plausible explanations rather than empirically demonstrated mediators. The findings also need to be considered alongside evidence that digital learning is not uniformly beneficial. Technology can improve learning when it provides cognitive support, feedback, and active learning opportunities, but merely replacing paper materials with digital versions may have little effect. This point is particularly important for E-LKPD research because “electronic” describes the format, not the pedagogical quality. Future studies should therefore distinguish between simple digitization and pedagogically enhanced E-LKPD.

The SKI context may offer an additional contribution. Historical and religious-cultural learning can be vulnerable to predominantly reproductive forms of instruction because students may be expected to remember narratives, figures, chronology, and factual information. An appropriately designed E-LKPD could broaden learning activities toward interpretation, contextualization, evidence-based reasoning, and reflection on historical values. Such a design would align more closely with contemporary views of technology-enhanced learning, in which technology is valuable when it changes or supports meaningful learning activity.

At the same time, the study’s cross-sectional design places clear limits on interpretation. Students who are already more motivated may be more likely to perceive E-LKPD favorably. Likewise, students with stronger academic performance may engage more positively with digital resources. Reverse causality and common-method bias are therefore possible. The present data cannot distinguish whether E-LKPD perceptions influence motivation and achievement, whether motivated students evaluate E-LKPD more positively, or whether both are associated with other factors such as teacher support, prior achievement, digital literacy, or home access to technology.

A second limitation concerns the measurement of achievement. The use of existing PAS scores is practical and ecologically valid, but it may not isolate learning attributable to E-LKPD. Achievement scores can reflect prior knowledge, teacher assessment practices, attendance, and other instructional experiences. A stronger future design would use standardized or researcher-developed pretest and posttest measures aligned with the learning objectives, together with a comparison group. A third limitation concerns generalizability. The study involved the entire accessible population of one madrasah and

therefore provides a complete census of that school but not a representative sample of Indonesian madrasahs. The results should consequently be interpreted as context-specific evidence. Multi-school studies involving different regions, school types, and student characteristics would provide stronger external validity.

Most importantly, the statistical model requires correction before substantive claims are made. The original Wilks' Lambda result is not sufficient evidence for a very large E-LKPD effect because the predictor appears to have been incorrectly specified as a high-degree-of-freedom categorical factor. Reanalysis with the continuous E-LKPD score is necessary. This correction is not merely technical: it may substantially change the magnitude and statistical significance of the association. A transparent manuscript should report the corrected multivariate test, individual regression coefficients, 95% confidence intervals, standardized coefficients, and explained variance for each outcome.

THEORETICAL AND PRACTICAL IMPLICATIONS

Theoretically, the study supports a shift from viewing E-LKPD as a digital artifact toward conceptualizing it as a structured learning environment. Its potential motivational and achievement-related value should be explained through the activities it affords, not through digitization alone. This perspective is consistent with evidence that technology-enhanced learning is more effective when it provides cognitive support and promotes active learning. Practically, SKI teachers should design E-LKPD around explicit learning objectives and cognitively meaningful activities. Interactive elements should have a pedagogical function rather than simply increase visual attractiveness. Tasks can be designed to require interpretation of historical evidence, comparison of events, explanation of causal relationships, reflection on values, and application of historical lessons to contemporary contexts. Feedback and opportunities for self-paced review may also help students experience greater competence and autonomy.

For school leaders, implementation should include teacher capacity, device accessibility, internet reliability, and monitoring of actual student engagement. For researchers, future studies should use experimental or quasi-experimental designs when the objective is to estimate causal effects. Randomized classroom studies or matched comparison designs would be substantially stronger than cross-sectional self-report studies.

LIMITATIONS AND FUTURE RESEARCH

This study has four principal limitations: the single-school sample, cross-sectional design, reliance on perceived E-LKPD use rather than objective usage data, and the need to correct the original multivariate model specification. In addition, the uploaded manuscript does not provide sufficient psychometric evidence for the instruments to permit an independent evaluation of construct validity. Future research should (a) preregister hypotheses and analysis plans where feasible; (b) validate the E-LKPD and motivation measures using exploratory and confirmatory factor analysis in appropriately sized samples; (c) incorporate pretest–posttest achievement measures; (d) include control or comparison groups; (e) collect usage-log data; and (f) test theoretically meaningful

mediators such as autonomy, competence, digital self-efficacy, engagement, or self-regulated learning. Multi-site research would also improve generalizability.

CONCLUSION

The study addresses an important question concerning the role of digital learning materials in SKI at the madrasah aliyah level. The original data indicate favorable student perceptions of E-LKPD, relatively high reported learning motivation, and satisfactory academic achievement. These patterns are consistent with contemporary research suggesting that digital technology can support learning when it is pedagogically integrated and encourages meaningful learning activity. However, the original manuscript's causal conclusion that E-LKPD has a very strong effect cannot be retained in its current form. The cross-sectional design does not support a causal inference, and the reported multivariate model appears to have treated the E-LKPD score as a categorical predictor, producing 40 hypothesis degrees of freedom. The reported achievement descriptive statistics are also internally inconsistent across the manuscript. These issues must be resolved through raw-data verification and reanalysis. After the statistical model is corrected, the study has the potential to make a useful contextual contribution to research on digital learning, motivation, and Islamic education. Its strongest contribution will come not from claiming that E-LKPD is inherently effective, but from demonstrating under what pedagogical and psychological conditions electronic worksheets are associated with meaningful student engagement and achievement.

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